The Xtal Set Society Newsletter

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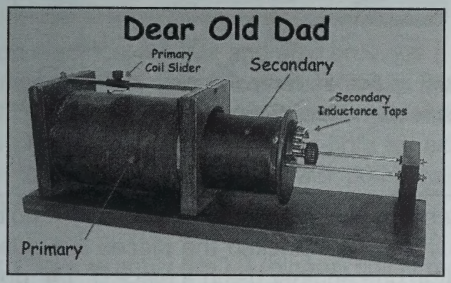
IMPORTANT MESSAGE
FROM THE QUEEN

The society has a new website. You can now use either midnightscience.com or midnightscience.net.

Son of Navy Coupler

by Dan Petersen, W7OIL



Back in the early days of radio, designs proliferated with pretty much "no holds barred" in designs. A lot of scientific research went into the design of early crystal radios but there was a lot of the "What happens when we do this" school of thought. Once the trick of detecting RF signals was refined, a subject all unto itself, there was the problem of getting the desired signal to the detector. Many of the first practical radios used very long wavelengths extending into the thousands of meters. Early signals were expressed in *meters* generally and not by *frequency* as we do today. To determine the frequency, the equation **300/ meter wavelength** is used. So for a wavelength of 300 meters the corresponding frequency is 1 megahertz. Early shipboard transmitters used to use around 600 meters or 500 kilohertz. Since BIG power could only be produced at relatively low frequencies a lot of stations would run at 2000 meters or higher wavelength. One legacy of this is the time station WWVB at 5000 meters or 60 kilohertz! A benefit of this is that WWVB is "relatively" immune to vagarities in propagation. That's why it is used to synchronize "atomic" clocks.

An early example of an apparatus used to tune the desired signal was known as the "Navy coupler". Also referred to as a "receiving transformer" or "loose coupler", These were designed to help couple the antenna system to the tuning coil while in many cases a slider shorted turns on the tuning coil to select the wavelength to be received. These tuning coils were relatively large in size and inductance, usually in the millihenry range. The "Son of Navy Coupler" is not as complex and tunes the AM Broadcast Band. rather than the "radio basement".

Figure 1 illustrates "Son of Navy Coupler". The whole idea of the design is to have the antenna coupling coil L1 movable to slide into and out of the tuning coil, L2. The L1 coil slides on two pieces of brass tubing. It also has a novel way to connect to the outside world by using two springs as sliding contacts. The tuning coil L2 is fixed on one end of the base of the assembly.

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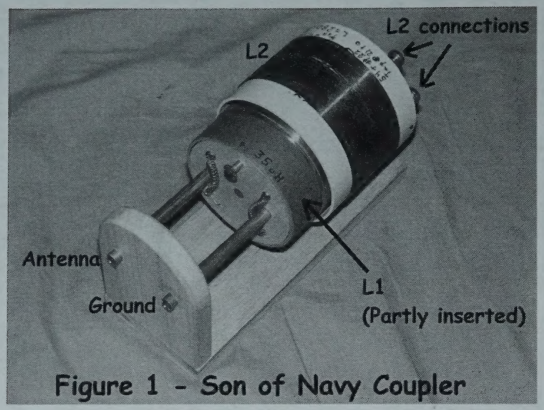

Figure 1 - Son of Navy Coupler

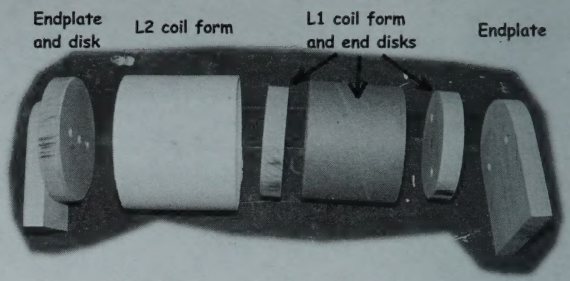

Figure 2 - Component parts

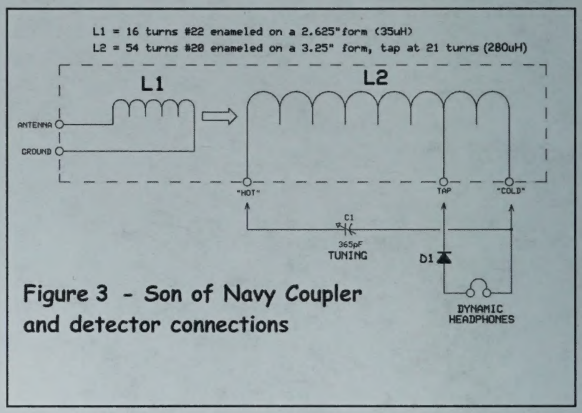

Figure 3 - Son of Navy Coupler and detector connections

Let's Get to Building!

Figure 2 is an exploded view of the component parts. The baseplate is a piece of 7" by 2.625" by 0.5" thick plywood I dug out of the scrap bin in the woodshop. The other parts are scrap pieces of poplar although there is no reason not to use other non-metallic materials. In Figure 2 the parts start at the left with the endplate and attached disk. The L2 coil form is a 2.75" long piece of 3.25" diameter PVC pipe. The L1 coil form and disks will form one unit but not yet! The L1 coil form is a 2-1/4" section of 2-5/8" diameter paper mailing tube. Finally the right endplate holds that end up. Before anything is glued and screwed together it is prudent to wind the two coils first. L1 is 16 turns of #22 enameled wire closewound centered on the paper coil form. The coil length was just less than 1/2". Bring both wires inside the coil and extend out the *same end*. In the case of L2 I went ahead and mounted the end-disk onto the PVC form after drilling all the necessary holes. L2 has 54 turns of #20 enameled wire closewound with a tap at 21 turns. Length of the winding is 1-7/16". All three wires are brought inside the coil form. It is important to tuck the wires up against the inside of the coil form back to the end-disk to allow clearance for L1 to slide in and out. The three wires go through the end-disk and connect to the terminals on the endplate.

Now for the Assembly:

All of the wood pieces are either full-circle disks or half-circle "headstone" shape. The two brass tubes have to be parallel to one another for this gizmo to work. To do this I determined the center of radius of all the pieces and drilled a 1/4" hole at that point. Then I stacked the pieces like a layer cake atop one another using a piece of 1/4" dowel through the center holes for an alignment device. I then marked 3/4" either side of the center and parallel with the "headstone". Using a drill press I drilled through the whole pile.

Figure 4 shows the spring contact arrangement. I had drilled out the holes in L1's end-disks to 9/32" to guarantee smooth sliding. The springs were harvested from two retractable pens, the ends bent down, then mounted with some tension to the end-disk. One coil wire went to each spring. The electrical contact between the springs and their brass tubes means the tubes become the antenna and ground connection points.

Figure 5 illustrates how the inner coil L1 is mounted on the brass tubing "rails". Note the springs are bending around the brass which provides

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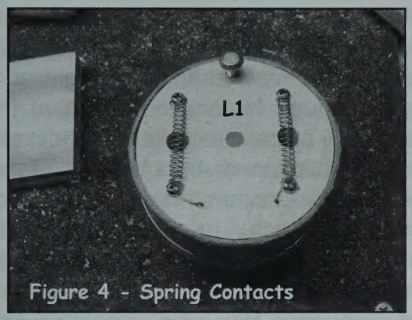

Figure 4 - Spring Contacts

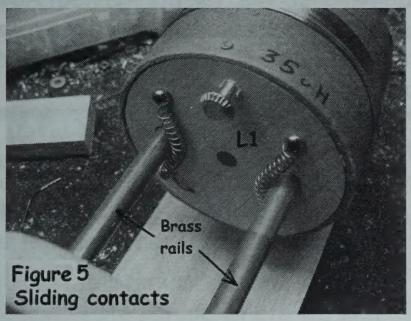

Figure 5
Sliding contacts

good electrical contact and also provides a sort of "braking" action so the coil doesn't slip back and forth too easily. You may note the brass stud at the top of the disk. This is a finger-hold for adjusting the coil position. A small drawer pull would work just as well.

For final assembly the L2 (bigger) coil is mounted onto one end of the baseplate. Then the two pieces of brass tubing are pushed into the corresponding holes inside L2. Coil L1 is then threaded onto the two tubes and finally the right endplate is pushed onto the tubes with perhaps ¼" sticking out past the end for attaching wires. Coil L1 should slide easily on the brass tubes with no binding. If needs be use a rat-tail file to enlarge the holes on L1. I found it took a bit of "fiddling" to get the whole assembly aligned.

So Now What?

The reason I did all this was to make a crystal set with it. There is not any rocket science here. The schematic in figure 3 shows how I connected a diode detector and a pair of headphones to the coupler. There is a variable capacitor of 360pF connected across L2 to tune the AM Broadcast Band. I have labeled the three terminals on L2 as "hot", "tap" and "cold". The cold end is usually referenced to ground although you may note that the detector and headphone are not connected to ground. I suppose using the term "common" for the cold end would be more appropriate. The detector diode, which in this case is an FO215 schottky unit, is connected to the tap. A germanium diode such as a 1N34 would work as well. I did fancy this set up with a vernier drive on the variable capacitor and I made a dial out of a CDROM.

A Lot **of Work, But is it Worth It?**

The long answer is…yes. I connected an antenna and ground to the set and used a pair of 4500-ohm dynamic headphones for listening. As predicted I can pick up most of the local BCB stations. The position of L1 makes a considerable difference in the volume of the

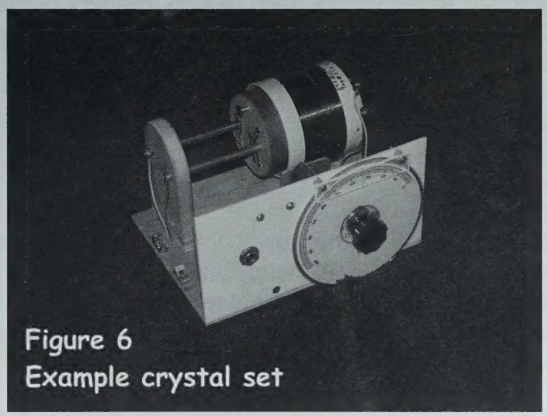
Figure 6
Example crystal set

received signal as well as the general selectivity. The farther I push in the coil the louder the signal is but at the cost of selectivity. There is also a tendency to shift the receive frequency as L1 is pushed in. There are always tradeoffs with crystal sets. If I connect the diode to the "hot" end of L2 the signals are much louder *but* there is more interference between stations. Selectivity and sensitivity are mutually exclusive. You just have to strive for a happy medium.

All in all I found this a satisfying project. This set will become one of my "test" radios for further experimentation. One experiment I plan for the future is to compare different ways for coupling the antenna to the rest of the set. Having the diode connected with fahnestock (FAWN-stock) clips means I can try different diodes. So get out there and build, explore and experiment!

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"*Things Radio*" - Interesting Aspects of our Hobby
"A Short Narrative of The Inventor of the Regenerative Radio Circuit"
By Randall Shreve, KD7PCW

In the March issue of the Xtal Society Newsletter there was an excellent article on "The Hiker's One" and Phil's 3S4 Test Regen Set. These are just two of perhaps thousands of regenerative designs. The basic regenerative circuit has lent itself over time to variances for specific applications and usages.

But who invented the regenerative radio?

In light of the 102-year anniversary of this popular and still today widely used design, readers of the Xtal Society Newsletter may find this very brief thumbnail history of the inventor interesting.

Edwin Howard Armstrong was born December 1890 in New York City. As a boy he had a strong interest in steam locomotives, electrical, and mechanical devices. He also had a keen and active interest in the new science of radio. As a young man Edwin Armstrong attended Columbia University and while an undergraduate designed and patented the regenerative circuit. The year was 1914.

Only two years earlier the infamous sinking of the RMS Titanic occurred. The world learned of the disaster by spark gap radio dispatches from ships at sea and the Marconi Radio Company was at the forefront of the technology at the time. Now it was 1914 and Europe was bracing for the beginning of World War I.

Many people don't realize that the United States was a late entry into World War One. As a country, the United States was deeply divided on the subject of involvement, with many wishing to remain neutral. Certain events, such as the sinking of the British Liner RMS Lusitania off the Irish Coast in 1915 by the German U-boat U-20, helped the Press to sway popular opinion.

As in all wars, advancements in technology are strongly sought after and used by all sides of a conflict. Radio was one of those technologies where the United States Army had a strong interest, but somewhat limited insight and talent. There is enough history to show that the Army relied heavily on new recruits with radio skills who helped establish new benchmarks of advancements in military communications. Armstrong was one of those many men who joined the U.S. Army's Signal Corp and with his education and patents was stationed in France assisting in radio communications. His talents gained Armstrong much deserved accolades and he was awarded the French Legion of Honor for his efforts and contributions during the war.

After the "War to End All Wars" concluded, Edwin Armstrong went on to invent the super-regenerative, super-heterodyne, frequency modulation (better know to most as FM radio) as well as other electronic designs." A truly brilliant and gifted man, Armstrong was also a true patriot. During both World War I and World War II he allowed the United States Government to use any and all of his patents and devices (and they did) without any monetary reimbursement or compensation. In 2016 it's hard to believe that a company, or person, would do such a thing. Obviously Edwin Armstrong wasn't in it for the money.

During his lifetime of electronics, which ended tragically in 1954, Edwin Armstrong was awarded many Radio and Electronic Engineering Awards.

As a crystal set enthusiast and Amateur Radio operator, I find it fascinating and downright awesome that one of Armstrong's first inventions, the 102-year-old regenerative circuit, is today still very much alive and being used all over the world from garage door openers to running remote industrial devices. There are thousands, if not millions, of regenerative circuits in daily use. I have been told that there was even an Amateur Radio kit offered in the early 1970's that was a one tube crystal controlled transceiver where the receiver section was actually a regenerative receiver. What a hoot that would be to find the circuit and recreate it to have one of those babies in your Ham shack today!

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Armstrong invented and patented many other devices as well. Like many of the early inventors, Armstrong soon found to his dismay that his patents were being infringed. Patent wars in the court system soon became common and Armstrong tried in vain to protect his inventions. Ironically, Edwin Armstrong had been good friends with the president of RCA and later married a lady who had been the secretary for said president. However, RCA was also one of the more powerful companies at the time that infringed upon Armstrong's patents (as well as other inventor's patents) and it was only after Armstrong's death RCA found itself losing many court cases thereby making Armstrong's widow a very wealth lady.

In closing this short narrative a moment of reflection is due as surely Edwin Armstrong had no idea that his creations would be so widely used. From the FM radio in our cars to the regenerative receiver that we might be building or opening our garage door in the middle of a blizzard, our thanks goes out to Mr. Edwin Armstrong, a radio pioneer and visionary.

About David McCartney
by Mark Rose

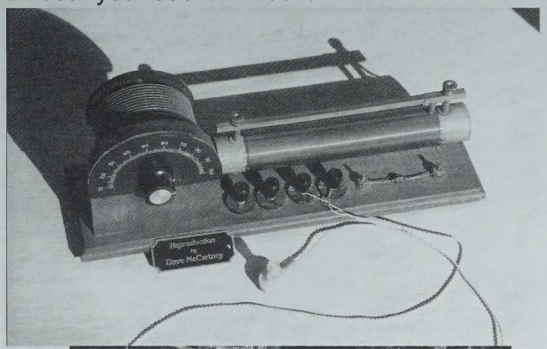
I am writing to "introduce" you to the work of David McCartney of Nebraska. David and his dad Julian are regulars at the antique Radio Club of Illinois Radiofest, where we first met him.

David builds outstanding quality crystal sets, not for profit, but to spread the word about the simple enjoyment of the crystal radio.

My then 8 year old son, Grant, and I first met David 3 years ago when we acquired one of his slider crystal sets of a design he chose to produce that year. My son keeps it hooked up next to his bed and says it tunes great and he has decent volume with a simple antenna of wire wrapped around his window frame. As with all his radios, it shows an incredible attention to detail.

This last summer we purchased one of David's wave traps and matching crystal sets. The quality can be seen in the photos. Trust me, the function is on the same level. David can be seen "dialing in" one of his creations while my son Grant stands alongside. Their antenna is a ten foot long, 1 inch diameter pipe wrapped with several hundred feet of coiled wire and the pipe is fastened to a metal plate that's anchored under the rear wheel of their van.

So that the passerby might listen too, David builds these incredible retro style speakers powered by a battery and a radio shack mini-amplifier. David's a very private person and unless you see him at one of these events,



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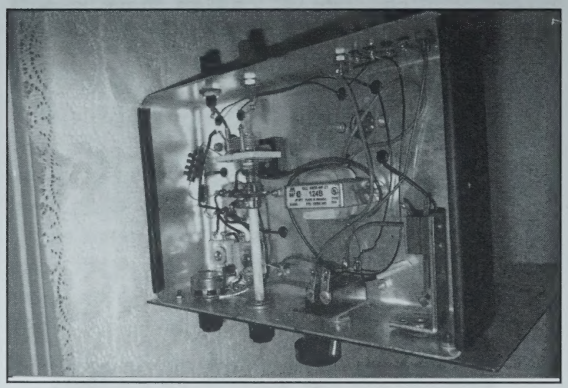
Acorn Tube Radio
by Larry Jeffers

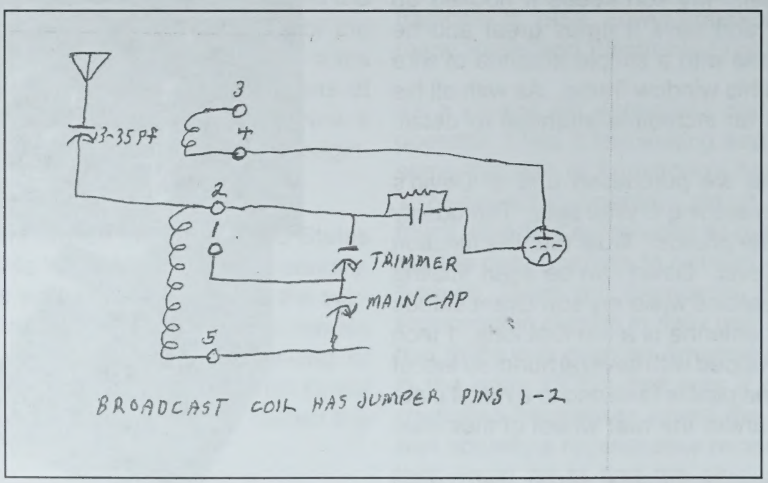
The January news letter with the article on the Bob Ryan radios stirred up thoughts of acorn tubes. I had to build something! My junk box was brimming with goodies, so I started digging. I had some nice 6X9 inch aluminum boxes that make good chassis along with a 6 1/2 inch X 10 inch aluminum panel. I was off and running.

I also had an old National type B variable ratio dial that takes 10 turns of the knob to transverse 480 degrees when set to the slow range. There are only so many ways to build a regen, so I settled on basically a Doerle circuit to use #2 958 acorns.

Back in the old days, short wave coils were made to tune with 140 pf capacitors, so where do we find one? Enter Old Elmer of Modern Radio Labs. Elmer used a trimmer in series with a standard capacitor to cut maximum capacity down to 140pf. That required more than one coil to cover the broadcast band-so now the reason for 5-prong coils. (see diagram)

The coil forms were made with pill bottles and old tube bases. The 5-prong base was used so a jumper could bypass the trimmer so only the main capacitor tunes a single coil to cover the broadcast band.





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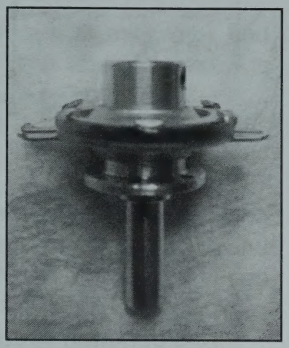
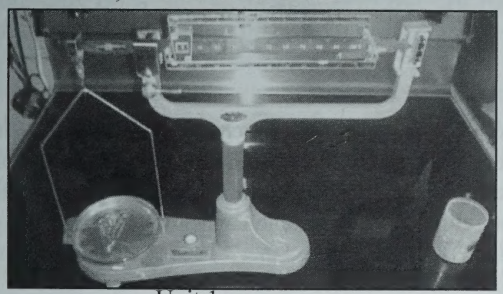
A test of Torque on the 6:1 Reduction Drive
by Kevin Sargent



A recent project required precise motor control of a 10 turn potentiometer. The first trial, using unipolar step motors was coarse, too many degrees per step. While waiting for bipolar motors and controllers to arrive, I pondered a "plan B" if they had the same problem. I went looking for planetary drives, having used them previously, but as a hand driven knob. I found the RD 6-1, exactly what I need, but wondered what rotational torque required. Step motors are notorious for losing position by "skipping" steps. Phil was candid that "It's never been asked before", so I ordered 2 to test.



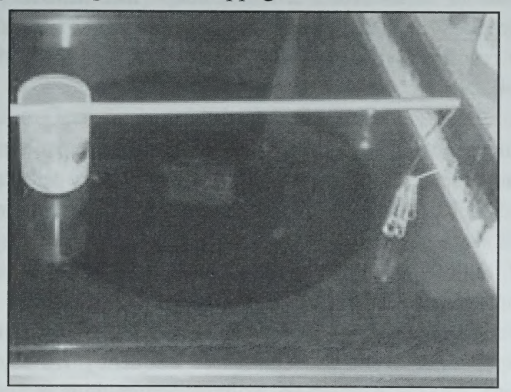
Unit 1

Center positioning a 36" brass tube gave it an 18" torque arm, without having to account for tube weight. After several trials, Unit 1 started to rotate with ~4.8 grams, Unit 2 held out to ~6.1 grams, all at ~62 degrees F. Both units are new, without any exercising to break them in, so these would qualify as worst case.

Doing unit conversion has Unit 1 at 3.1 ounce-inch and Unit 2 at 3.9. Neither figure is lower than most step motor holding torques, but running is much different. Step drive torque falls off rapidly after full and half steps into the managed current or "micro-stepping" modes. Between wanting the smallest steps and a reasonable stepping speed, freeing up the required torque was worth exploring.

Neither soaking in degreaser nor acetone made a noticeable difference. Given its construction, the area where the input shaft is inside the output was suspect. Any grease in that area would both contribute much to overall torque but also be near impossible to remove by soaking. Unfortunately, disassembly is next.

Caution required hereafter... disassemble is easy, reassembly is Not. Without reasonable experience and a compelling need to minimize rotational torque, Stop, it isn't worth it. Suitably advised, one unit was disassembled, completely cleaned, inspected for burrs and flashings and reassembled. Of note, on inspection and deburring, "several" bits of brass cuttings came out. Not to fault the manufacturer, these would have negligible effect in a hand driven application. This is the pursuit of the best the mechanism can be. Be particularly careful in opening and recrimping the tabs to not warp the shell. In recrimping, apply just enough pressure to evenly compress the wave spring until the input to output has no slippage.



Method 1

Since this application is low speed (~2Sec/Rot) and intermittent, no lubrication was used. New torque test is <.4 gram or .25 ounce-inch, a satisfying result versus the effort. Only one unit was rebuilt, the bipolar motor & micro stepping controller solved the original problem. However, at such a reasonable price and effort to optimize, this is one more option when else isn't enough.

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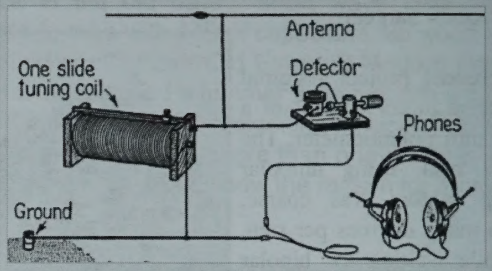
Best Antenna For A Picard Crystal Set?
Hello Phil. I recently bought and put together a Pickard Set and I live in an apartment and am wondering the best way to do the antenna. Is it possible to create a short antenna for it? I haven't been able to get it working. Thanks. Dustin.

Hi Dustin. There could be several possibilities why it is not working: not a strong enough local station, antenna capacitance is too small or two large, detector not working, stand headphones loading down the detector, etc.

As I recall, Pickard was known for his crystal detector made from galena and a cat whisker, which he patented. There are many crystal radio sets/kits out there identified as a "Packard Crystal Set" and they vary in design, schematic and construction. **I'm guessing that most of them utilize a slider coil – like that in the picture – and utilize the capacitance of the antenna to resonate with the inductance setting of the slider coil.**

One problem with this design is that the capacitance and resistance of a given antenna can vary substantially depending upon its length, height, orientation, etc. A short antenna relative to the quarter-wavelength of radio waves for the AM band will have a high capacitance. This forces one to move the slider in order to make the inductance resonate with the antenna capacitance at the chosen receive frequency. However, with this arrangement the voltage generated is reduced compared to a bigger length coil and a much smaller capacitance.

One solution is to put a small capacitance is series with the antenna, forcing the total capacitance of the antenna to a small value. I suggest trying 100 to 200 pfs. Then you can move the slider up so that the coil is longer and as such produces more volume for the detector. If you have a variable capacitor, put it in series with the incoming antenna and try your set again.
I hope that finds you success. 73, Phil, WØXI,



Pictorial diagram from 1922 showing the circuit of a crystal radio. This common circuit did not use a tuning capacitor, but used the capacitance of the antenna to form the tuned circuit with the coil. The detector might have been a piece of galena with a whisker wire in contact with it on a part of the crystal, making a diode contact

From Dewey: Hi. I just purchased your XS-402 Little Wonder Crystal Radio kit (and a couple others). It works pretty cool. Question, though. Am I to assume that both clips on C1 (variable capacitor) on each side get folded and soldered together? I ask because sometimes when I adjust it I get the same station regardless of the position.

Also, when I hook jumper J6 to gnd to connect C2 I still get the same station as I got without the jumper. Is that normal? Thanks! Dewey .

Hello Dewey
There could be several interpretations regarding your experience. However, the leads/leaves at one end of your mica-capacitor are not soldered to the leaves at the other end. However the leaves at each are soldered together just at their end. If you look closely – use a magnifier – there are little pieces of mica between the leads from the left and the leads from the right, i.e. coming in from each end; so, as such the capacitance is formed by each end not being connected to the other thus forming two plates with a separation between them at determines the capacitance. When you

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tighten the screw and "plates" are forced closer together thus increasing the capacitance.

I measured the capacitance with my meter and noticed – approximately – that when the screw is tight the capacitance total is about 270 pf..... when the screw is very loose, the capacitance is about 70 pf.

With 250uH for a coil, J1 and J2 in series, one needs about 50 pf to 60 pf to tune 1500 AM and about 340 pf to tune 550 kHz AM. The 100 pf cap is added, if need be, and works in some cases.

Also, the capacitance of the antenna comes into play and for, let's say about 50 feet of antenna, a typical antenna will "look" capacitive and in the range of 300 pf or more capacitance.

As such, the XS402 set is very basic and would likely pick up a strong local station but not tune sufficiently to truly tune the whole band.

There is no "normal" given that each person's antenna will present a difference in capacitance from another, due to varied height, length and grounding.

To achieve accurate tuning, one has to have an antenna tuner between the antenna and a crystal set; and, the crystal set would have to have a high-Q, high quality coil and air-variable capacitor.

This is why crystal sets are so much fun..... You might try going bare bones just for fun, attaching your antenna to the 1N34 diode which in turn is attached to the ear piece and a 47K resistor in parallel and then to ground. Works great if you are near an AM station. No tuning, hi. Phil

Dewey: Thank you for getting back with me. I do have the variable cap installed correctly.

Sure as heck, as soon as I email you the band opens up. I've tuned 3 different stations or several have piled up on each other. Other times it's quiet. I've gotten our local station out of Roanoke at various times of the day. It's 20 or so miles away. I've gotten WCBS out of NJ or NY. And I've gotten one out of Ohio. I'm having a blast. I'll study your notes and see what to experiment with.

I put together the XS-500 kit today. Wow! Several stations are loud and clear. I know they are distant, too. It's amazing. **The stations sound like short wave stations. I'm definitely experimenting with this** one. It's a lot of fun. When I next buy oatmeal I'll put together that kit. Thanks again for your help. I appreciate it. Take care.

From James T. Hawes AA9DT:
I particularly enjoyed the recent article on space-charge and low-power tube receivers. Readers need not regret the rarity of the famous 49 tube. It isn't the only space-charge tube. A list of 45 space-charge tubes appears at the Web site Junkbox.com. Some of these tubes are much more common than a 49. See...http://goo.gl/uWvq7q

Here are the top five tubes on the list: 6GM8, 12AC6, 12AD6, 12AE6, 12AE7. The Web site links to full datasheets. The page also offers how-to tips. The tips include what to expect when running non-space charge tubes at low voltages.

Hugo Gernsback published his unusual "Megadyne" circuit in various 1930s magazines. (The lamented Lindsay Publications reproduced several of these books.) The Megadyne is similar to the space-charge circuits in the XSS article: The Megadyne reverses the screen and control grid functions.

Interestingly, the space effect operates in the audio stage, instead of the detector. This one-tube set could drive a high-impedance (magnetic) speaker. This is really an amplified crystal set. After the screen grid leak, the Megadyne uses an iron pyrite crystal detector. The control grid connects to the feedback side of a tunable input transformer. The tube is a 38, an early pentode. See...http://goo.gl/iKXuKp

I own a BC-1206, which is a superhet aircraft receiver. This longwave set (195 to 420 kHz) might be useful for picking up navigation signals. The manufacturer is Setchell-Carlson.

This receiver is a low-power set. It is also the smallest "boat anchor" tube radio. Despite using octal tubes, the BC-1206 would fit into a shoebox! (Size: 4 x 4 x 6.5

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inches.) My guess is that the tube spacing can be tight due to very low heating from low-voltage operation. The five tubes include: RF, 14H7; mixer (4, not 5 grids), 14J7; IF, 14H7; second detector and first audio, 14R7; and SE output, 28D7. The set drives phones, either 300 or 4K ohm. See...http://radionerds.com/index.php/BC-1206

Although it uses two tetrodes in the output stages, I don't think that this is a space-charge set. The plate voltage is just extremely low, 28 volts!

Many years ago, my BC-1206 arrived in its original box from Fair Radio Sales. I bought used tubes for much more than the radio cost. The set was mechanically OK, but inoperable and missing its power supply filter capacitors. Since I didn't have a schematic, I ignored the missing parts.

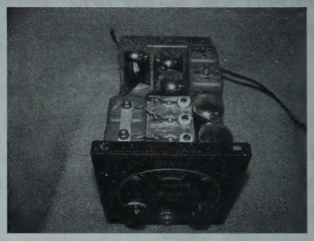
Peeking under the chassis, I found many wax tubular capacitors in sad shape. I recapped the set. Some of the capacitors were difficult to remove. You can imagine the cramped space under the tiny chassis!

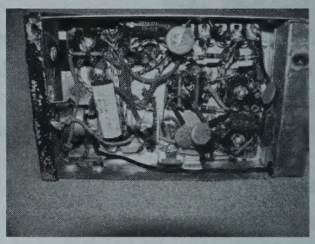
Since I didn't have a 28-volt power supply, I tried operating the radio on 12 volts. I improvised a completely inadequate wire antenna of random length. I laid this wire on the floor. With this unfortunate setup, all I could hear is subharmonics of WGN, 720 AM. (We're about 15 or 20 miles from the WGN tower.)

I'd planned to try to reduce the bottom frequency to 160 kHz. At the time, I was interested in longwave amateur activity on 160 to 190 kHz. I never got around to further modifications.

My wife and I are on the board of the local ham club SRO. A late board member once told me that his first ham receiver was a BC-1206. He'd modified the input tank to receive shortwaves.
James T. Hawes AA9DT

This is a bit more about my BC-1206 boat longwave receiver. I excavated it from the collection and took photos. I've attached the two best shots: (A) The top of the radio with loctal (loktal) tubes. (B) Below the chassis, showing new capacitors and other parts. The chassis is only a few inches across!

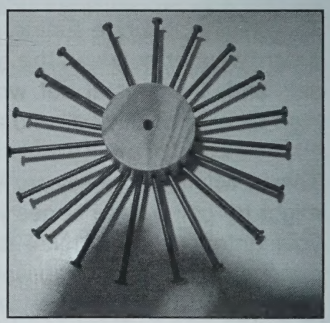




I rechecked the back of the radio, where the power LC filter is. (Not in the pictures.) I was wrong about the capacitors. They look new. Maybe I (or someone) replaced them. The filter choke is probably okay, but it has a crumbling paper cover.

The circuit divides the input 28 volts in two. Fourteen volts lights each of four tube filaments. The last two tubes are in one envelope with a 28-volt filament. This is the audio power amp, a 28D7. Instead of running push-pull, this tube runs with the plates in parallel. Probably there isn't enough voltage for push-pull operation. The same 28 volts connects to the tube plates. This little gem probably still works!

[My apologies to Ken Ladd. On page 9 of the March issue "Some Like it Hot" is his, but it looks like it came from Ken Finn.]



From Ken Ladd: I decided to try my hand at making a spider web coil form. I took a wooden cut out left from another project measured the diameter and multiplied it times pi but since the calculator did not have that feature is used 22/7. I calculated the spacing as close as I could and and used a cardboard template and a ice pick to mark the nail hole locations. The last set was a little off but it probably won't matter.

It came from the January 1925 Popular Mechanics and the radio plan I am working on. I just had never tried it before.

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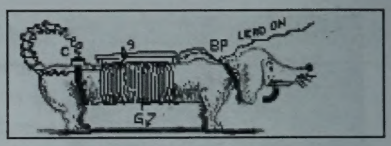

We are dedicated to once again building and experimenting with radio electronics, often—but not always—through the use of the crystal set, the basis for most modern day radio apparatus. This newsletter helps support our goal of producing excellent quality technical books that encourage learning and building. To join the society and receive one year of the bi-monthly newsletter, remit $14.95 to The Xtal Set Society. Canadians, please remit US $15.95. Outside the US and Canada please remit US $21.95.

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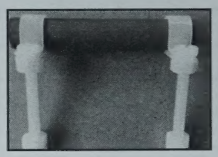
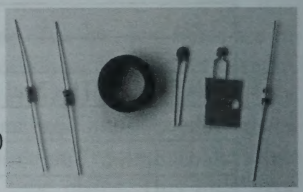
Nylon Form for Rod



This set of nylon parts combine as a form for the ferrite rod, thus preserving the Q of the rod mounted above a chassis. The Rod is not included. Nylon Form rod $2.50

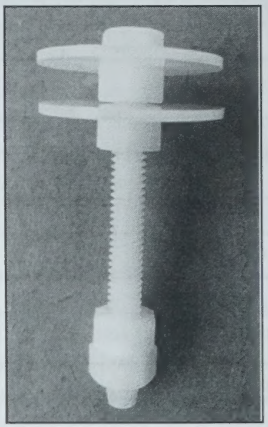
R-L-C-D Assortment



This assortment has nearly all the parts to build a basic am crystal set: 100 pf cap, 330 pf cap, am-band toroidal coil form (ft-82-61), 47k and 100k resistors and a 1n34 diode. RLCD 5.95

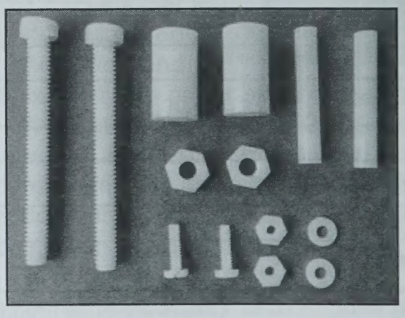
Nylon Form for Core

These nylon plastic pieces combine as a form for the various ferrite toroid coils we offer. The form is low loss thus preserving the Q of the coil wound on the form. Extending them above the chassis - which might be metal or fiber board also preserves the coil Q. nycorefrm $2.50



Nylon Assortment

This nylon assortment includes two each of the following: 0.25 by 2.5 inch bolts and 0.25 hex nuts; 6-32 by 0.5 inch screw with 6-32 hex nuts and two 6.32 washers; two 0.5 by 1 inch standoffs (with 0.25 through hole, and 0.25 by 1.5 inch standoffs. the latter two can be tapped and connected as a shaft extender for our variable capacitors. Nylassort $3.50



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